IOWA DEPARTMENT OF PUBLIC HEALTH

DIVISION OF ACUTE DISEASE PREVENTON AND EMERGENCY RESPONSE

BUREAU OF IMMUNIZATION AND TUBERCULOSIS

Iowa Tuberculosis Control Program Annual Report 2011

CERTAMEN AD FINEM PERGIT
THE FIGHT CONTINUES TO THE END

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Contents

Purpose and Overview

The purpose of this report is to provide a summary of Tuberculosis (TB) in Iowa and the activities and achievements of the TB Control Program and our partners during the 2011 calendar year. This report provides Iowa-specific TB rates, funding sources, and program-specific data.

The annual report will serve as an informational resource for stakeholders, local partners, policy makers and the general public. To report will be distributed electronically and will be available for download on the TB Control Program Web page http://www.idph.state.ia.us/ImmTB/TB.aspx?prog=Tb&pg=TbHome

Iowa's TB Control Program

The TB Program is comprised of two full time employees: the Program Manager and the TB Nurse Consultant. The program provides direct oversight of cases afflicted with LTBI and TB disease from admission to discharge in the TB Control Program. This includes consultation to physicians, nurses, local public health agencies (LPHAs) and other healthcare providers regarding TB transmission, pathogenesis, treatment, signs and symptoms, infection control practices, and contact investigations. The purpose and scope of responsibilities is defined by the core functions of the TB Control Program which include:

- Disease consultation and education
- Investigation of active or suspect TB cases
- Case management of active TB cases
- Administration of Iowa's TB Medication Program
- Data management
- Data analysis
- Administration and finance

Introduction

TB has devastated entire families, generations and countries throughout human history. Science has demonstrated that TB has been present in humans for thousands of years. In 2008, the discovery of the earliest known cases of human TB (9,000 years old) was found in skeletal remains submerged off the coast of Israel, showing the disease is older than previously thought. The bones, thought to be of a mother and baby, were excavated from Alit-Yam, a 9,000 year-old Pre-Pottery Neolithic village, which has been submerged off the coast of Haifa, Israel for thousands of years[1].

The 9,000-year-old remains of a mother and her baby discovered off the coast of Israel provide the earliest concrete evidence of human TB, say researchers.

Writers have described TB since the dawn of recorded human history, dating back approximately 5,000 years ago. Some authors call TB the first disease known to mankind. Throughout history, people called TB by many names including consumption, phthisis, scrofula, Pott's disease and the White Plague. Because TB can manifest itself in any part of the body, scientist did not identify it as a unified disease until the 1820's and J.L. Schonlein, a German Professor of Medicine, formally named *Tuberculosis* in 1839.

[1] *Science Daily (Oct. 14, 2008)*.

For centuries, medicine could only speculate what caused TB. Doctors and others attempted various approaches seeking a cure including bloodletting, induced vomiting and inhaling animal dung. During the Middle Ages thousands of people sought the "King's touch" to cure scrofula (lymphatic TB).

Queen Anne of England was one of the last monarchs to perform the "king's touch" as a cure for lymphatic TB.

TB treatments ran a broad spectrum from prescribed "courses" of starvation to overfeeding, bed rest to extensive exercise and bathing in urine vs. emphasis on personal cleanliness. In the early 20th century, doctors implemented widespread use of pneumothorax, or surgically collapsing the lungs, as a means of treatment.

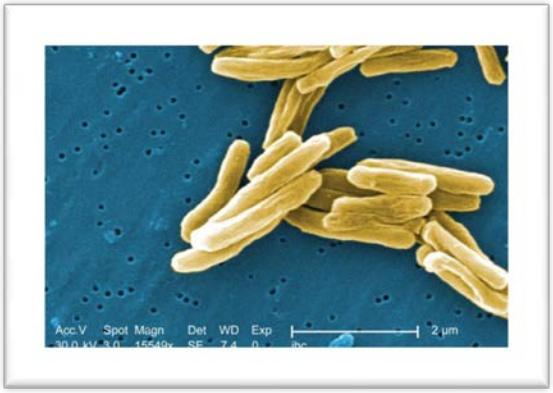
Eventually, all of these methods gave way to the modern era of TB treatment, notably the use of multiple antibiotics to cure TB disease. Before the discussion can go further, it is important to understand the difference between TB infection, known as latent TB infection or LTBI, and TB disease.

The Difference between Latent TB Infection and TB Disease:

From CDC's Division of TB Elimination

What is TB?

Tuberculosis (TB) is a disease caused by a germ called *Mycobacterium tuberculosis* that is spread from person to person through the air.



Mycobacterium tuberculosis scanning electron micrograph. Mag 15549X. CDC.

TB usually affects the lungs, but it can also affect other parts of the body, such as the brain, the kidneys, or the spine. When a person with infectious TB coughs or sneezes, droplet nuclei containing *M. tuberculosis* are expelled into the air. If another person inhales air containing these droplet nuclei, he or she may become infected. However, not everyone infected with TB bacteria becomes sick. As a result, two TB-related conditions exist: latent TB infection and TB disease.

What is Latent TB Infection?

Persons with latent TB infection do not feel sick and do not have any symptoms. They are infected with *M. tuberculosis*, but do not have TB disease. The only sign of TB infection is a positive reaction to the tuberculin skin test or TB blood test. **Persons with latent TB infection are not infectious and cannot spread TB infection to others**.

A person with latent TB infection
• Usually has a skin test or blood test result indicating TB infection
• Has a normal chest x-ray and a negative sputum test
• Has TB bacteria in his/her body that are alive, but inactive
• Does not feel sick
• Cannot spread TB bacteria to others
• Needs treatment for latent TB infection to prevent TB disease; however, if exposed and infected by a person with multidrug-resistant TB (MDR TB) or extensively drug-resistant TB (XDR TB), preventive treatment may not be an option

Figure 1: LTBI Characteristics

Overall, without treatment, about 5 to 10% of infected persons will develop TB disease at some time in their lives. About half of those people who develop TB will do so within the first two years of infection. For persons whose immune systems are weak, especially those with HIV infection, the risk of developing TB disease is considerably higher than for persons with normal immune systems.
Of special concern are persons infected by someone with extensively drug-resistant TB (XDR TB) who later develop TB disease; these persons will have XDR TB, not regular TB disease.

What is TB Disease?

In some people, TB bacteria overcome the defenses of the immune system and begin to multiply, resulting in the progression from latent TB infection to TB disease. Some people develop TB disease soon after infection, while others develop TB disease later when their immune system becomes weak.

The general symptoms of TB disease include:

- Unexplained weight loss
- Loss of appetite
- Night sweats
- Fever
- Fatigue
- Chills

The symptoms of TB of the lungs include:

- Coughing for 3 weeks or longer
- Hemoptysis (coughing up blood)
- Chest pain

Other symptoms depend on the part of the body that is affected. **Persons with TB disease are considered infectious and may spread TB bacteria to others**. If TB disease is suspected, persons should be referred for a complete medical evaluation. If it is determined that a person has TB disease, therapy is given to treat it. TB disease is a serious condition and can lead to death if not treated.

A person with TB disease
• Usually has a skin test or blood test result indicating TB infection
• May have an abnormal chest x-ray, or positive sputum smear or culture
• Has TB bacteria in his/her body
• Usually feels sick and may have symptoms such as coughing, fever, and weight loss
• May spread TB bacteria to others
• Needs treatment to treat TB disease

Figure 2: TB Disease Characteristics

History of TB in the United States

TB was among the top leading causes of death during the early part of the 20th Century, claiming over 90,000 lives annually in the United States. TB afflicted men, women and children of all ages, classes and geographic locations. A vicious disease characterized by extreme fatigue, drenching night sweats and a distressing cough, TB literally caused the body to waste away. In advanced stages, people would cough up blood from damaged and dying lung tissue. Due to its infectious nature, several members of a family often suffered from TB.

Development of Sanatoriums

In the 19th century, TB was the major threat to health in Europe and North America. It was thought to be caused by heredity compounded by one's way of life and, even when proved to be an infection, these factors were thought to identify who would catch it.

In 1854, Hermann Brehmer asserted that he could cure TB with a regimen of fresh air, exercise and good nutrition in a sanatorium. Although the medical establishment initially rejected Brehmer's ideas the sanatorium movement steadily caught hold, and within two decades was supported by eminent physicians. Rest replaced Brehmer's exercise, as the key remedy[2].

In 1885 Edward Livingston Trudeau, an American physician, established the Adirondack Cottage Sanitarium at Saranac Lake for treatment of TB. Soon, most large communities built their own sanatoriums.

Oakdale TB Sanatorium, Oakdale, Iowa

Iowa followed this practice as well. Built in 1907, Oakdale Sanatorium was the oldest and largest public TB sanatorium in Iowa. Oakdale served thousands of TB patients until declining usage finally closed its doors in 1981.

The building remained in use, including serving as the States TB laboratory until 2010. In March 2011, wrecking balls tore the historic building down to pave the way for the modern State Hygienic Lab. The Oakdale Sanatorium, and others like Sunny Crest in Dubuque and Broadlawns in Des Moines, were key to isolating infectious TB patients from the rest of the communities in Iowa.

In 1906, about 7,000 to 8,000 Iowans had TB. The State Board of Health and the Iowa Tuberculosis Association worked together to spread information about prevention. They pushed for early testing. [3]

The National Tuberculosis Association, now known as the American Lung Association (ALA), pioneered Christmas Seals to help raise funds to fight TB. The same year Iowa's Oakdale Sanatorium was built, 1907, a small Sanatorium in Delaware was in

[2] *The Evolution of the Sanatorium: the first half-century, 1854-1904.* Warren P Faculty of Medicine, University of Manitoba.

[3] *Tuberculosis: The White Plague in Iowa.* Adapted from original article by Ginalie Swaim, Iowa Heritage Illustrated 86, No. 2 (Summer 2005). Iowa City: State Historical Society of Iowa.

jeopardy of closing its doors due to lack of funding. Emily Bissell, a cousin of the sanatoriums' doctor, and veteran fund raiser, developed a plan to sell holiday seals at the local post office for a penny each. At the end of the holiday season, and high profile endorsement by President Roosevelt, the group had raised ten times the needed amount and American Lung Association Christmas Seals were born. The program continues as a fundraiser today.

Samples of Christmas Seals – American Lung Association

In 1902, the ALA first used the Cross of Lorraine as a symbol for the "crusade" against TB. Many old TB sanatoriums prominently displayed this battle standard atop their buildings (see upper right corner of the Oakdale Sanatorium – photo last page). Some claim a dual purpose was to "warn" others to stay away from the area as people with deadly TB were gathered.

Modern Era of TB Control

The discovery of streptomycin in 1944 and Isoniazid (INH) in 1952 heralded the modern era of TB treatment. The use of INH signaled the '*beginning of the end*' for TB sanatoriums. However, science soon learned that single drug therapy resulted in treatment relapse. This led to the eventual use of a multi-drug treatment approach that demonstrated TB to be curable. Today, the use of an initial four-drug therapy to cure TB is the standard of practice in TB Control.

By the 1960's, TB elimination was a foregone conclusion by most public health experts. Steadily declining TB rates from 1953- 1984 strengthened this conclusion. Then, a 20% resurgence in reported TB cases from 1985 – 1992 shattered this belief. The major factors contributing to this resurgence were:

- A deterioration of the TB public health infrastructure
- The HIV/AIDS epidemic
- Immigration from countries where TB is prevalent
- Transmission of TB in congregate settings (e.g., health care facilities, correctional facilities, homeless shelters)

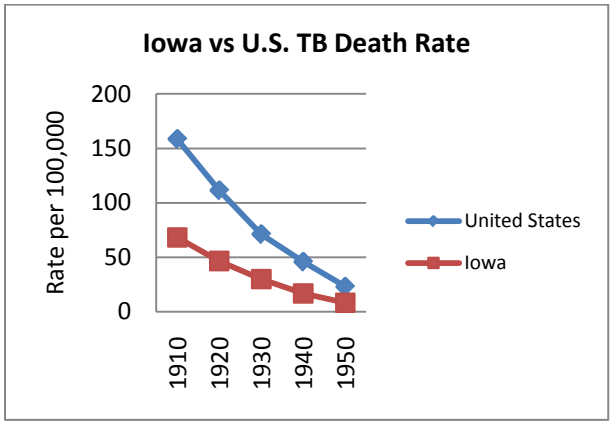


Figure 3: TB Death Rate Iowa vs. U.S. 1910-50

Figure 3 demonstrates the rapid decline of deaths associated with TB in the United States and Iowa from 1910 – 1950. Note the dramatic decline began even **before** the discovery of effective TB drugs in the 1940s. Scientists liken this as part of the 'normal' epidemic wave of disease. During an epidemic, the number of new cases (infected individuals) increases rapidly to a peak and then falls more gradually until the epidemic is over. This happens with all diseases including TB. *"In Europe, TB was present throughout the middle ages, but it was in the seventeenth century that it reached what can only be considered astounding epidemic proportions… The tide of consumption receded somewhat in the eighteenth century, only to rise again in the nineteenth century before beginning a rapid decline that continued steadily until recent times."* [4]

[4] *Captain of Death: The Story of Tuberculosis* by Thomas M. Daniel

International Burden of TB Disease:

From the World Health Organization

The TB Epidemic and Response

TB is contagious and airborne. It is a disease of poverty affecting mostly young adults in their most productive years. 95% of TB deaths are in the developing world. The number of people who fell ill with TB dropped to 8.8 million in 2010, including 1.1 million cases among people with HIV. The number has been falling since 2005. The estimated global incidence rate fell to 128 cases per 100,000 population in 2010, after peaking in 2002 at 141 cases per 100,000. The rate of TB is falling but very slowly.

The number of people who died from TB fell to 1.4 million in 2010, including 350,000 people with HIV, equal to 3,800 deaths a day. In 2009, there were 9.7 million orphan children as a result of TB deaths. TB is among the three greatest causes of death among women aged 15-44, 320,000 women died from TB in 2010. The TB death rate has fallen by 40% since 1990, and the number of deaths is also declining. 5.7 million TB cases were notified through TB Directly Observed Therapy Short Course (DOTS) programs in 2010.

Globally, the percentage of people successfully treated reached its highest level at 87% in 2009. Since 1995, 46 million people have been successfully treated and up to 6.8 million lives saved through DOTS and the Stop TB Strategy.

Multidrug Resistant TB

In 2010, there was an estimated prevalence of 650,000 cases of multidrug-resistant TB (MDR-TB), and in 2008 it was estimated there were 150,000 MDR-TB deaths annually worldwide. The number of patients enrolled on MDR-TB treatment increased to 46,000 in 2010. While more people are being treated for MDR-TB in 2010, it is just 16% of the estimated number of MDR-TB patients that needed treatment (i.e. More MDR-TB patients that would be identified if all newly-notified TB patients were tested for drug resistance.)

Status of TB in the U.S:

From CDC's Division of TB Elimination

A total of 11,182 TB cases (a rate of 3.6 cases per 100,000 persons) were reported in the United States in 2010. Both the number of TB cases reported and the case rate decreased; this represents a 3.1% and 3.8% decline, respectively, compared to 2009. The number of reported TB cases in 2010 was the lowest recorded since national reporting began in 1953.

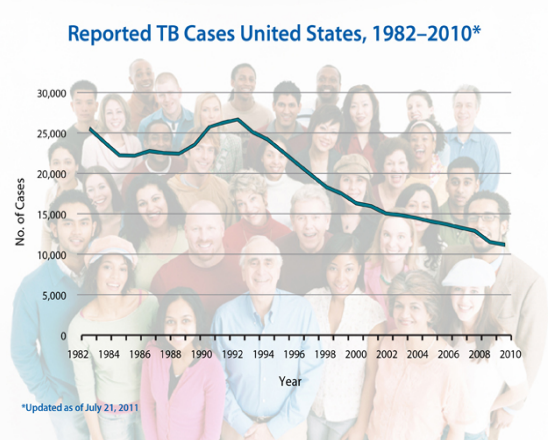


Figure 4: Reported TB Cases in US 1982-2010

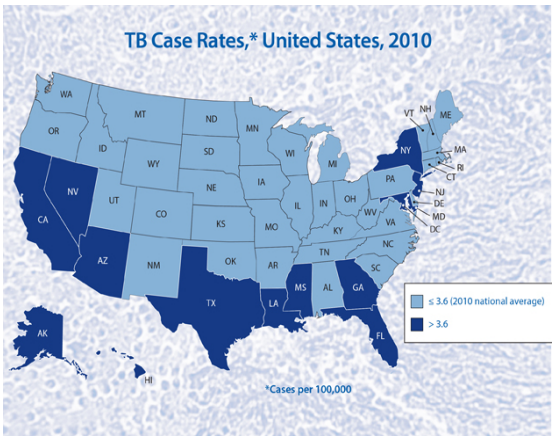


Figure 5: TB Case Rates: U.S. 2010

Since the 1992 TB resurgence peak in the United States, the number of TB cases reported annually has decreased. Case count and case rate declines in 2009 were considerably steeper than in recent years.

In 2010, 60% of reported TB cases in the United States occurred in foreign-born persons. The case rate among foreign-born persons (18.1 cases per 100,000) in 2010 was approximately 11 times higher than among U.S.-born persons (1.6 cases per 100,000).

Rates of TB for different racial and ethnic populations (per 100,000)	
American Indians or Alaska Natives	6.4
Asians	22.4
Blacks	7.0
Native Hawaiians / Pacific Islanders	20.8
Hispanics or Latinos	6.5
Whites	0.9

Figure 6: Rates of TB among Racial and Ethnic Populations. Source: World Health Organization

MDR TB

Since 1993, when the TB surveillance system was expanded to include drug-susceptibility results, reported multidrug-resistant (MDR) TB cases have decreased in the United States. Primary multidrug-resistant TB (MDR TB) is defined as no previous history of TB disease and is resistant to at least isoniazid and rifampin, the two best first-line TB treatment drugs. Among TB cases in the United States with initial drug-susceptibility testing results who did not have prior treatment, the percentage of primary MDR TB cases changed slightly from 1.1% (94 cases) in 2009 to 1.2% (88 cases) in 2010.

Since 1998, the percentage of U.S.-born patients with primary MDR TB has remained at 0.7%. However, of the total number of reported primary MDR TB cases, the proportion occurring in foreign-born persons increased from 25.3% (103 of 407) in 1993, to 82% (72 of 88) in 2010.

TB Morbidity and Trends in Iowa

The number of TB cases in Iowa, as in the rest of the U.S., has significantly declined since the discovery of antibiotics that kill the TB bacilli. Despite drugs that can cure TB disease, TB remains a significant public health issue in Iowa and the rest of the country. During the last decade, Iowa averaged over 1,300 TB infections and 43 TB disease cases each year. Figure 7 illustrates the average number of cases in Iowa each year by decade, dating back to 1930. Note that Iowa averaged 757 cases of TB disease each year during the decade of the 1940s. Figure 8 Illustrates the number of LTBIs each year from 1999- 2011. Persons with untreated LTBI represent the reservoir of future TB cases.

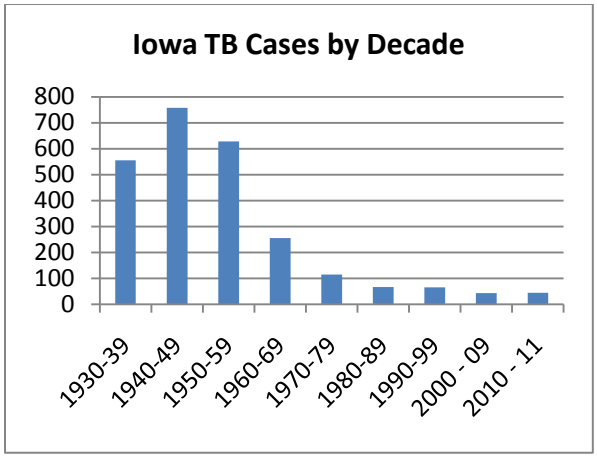


Figure 7: Average Number of TB Cases in Iowa Each Year by Decade.

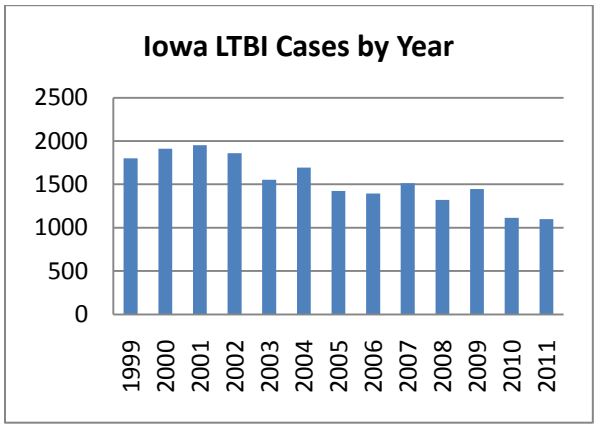


Figure 8: Number of LTBI cases each year from 1999-2011

Directly Observed Therapy (DOT)

DOT is a strategy used by public health officials to assure patients with TB disease are correctly treated and cured. DOT is the standard of care for all patients afflicted with TB disease. The Centers for Disease Control and Prevention(CDC), Infectious Diseases Society of America(IDS), World Health Organization(WHO), and the American Thoracic Society(ATS) recommend healthcare providers implement DOT on each case of TB disease. With DOT, a designated healthcare worker watches a patient swallow each dose of TB medication. Without DOT, many patients do not take their medication properly, resulting in disease relapse, treatment failure and development of drug resistance, including multidrug-resistant TB (MDR-TB).

In 2001, the Iowa TB Control Program began providing DOT incentive funds to increase the proportion of TB patients who receive DOT. Since implementation of incentive funding, DOT rates have risen 40% in Iowa (Figure 9). During this time-period, virtually all pulmonary (infectious) cases of TB have had the benefit of DOT. Clinical benefits of DOT include significant reduction in disease relapse, treatment failure and development of multidrug-resistant TB (MDR-TB).

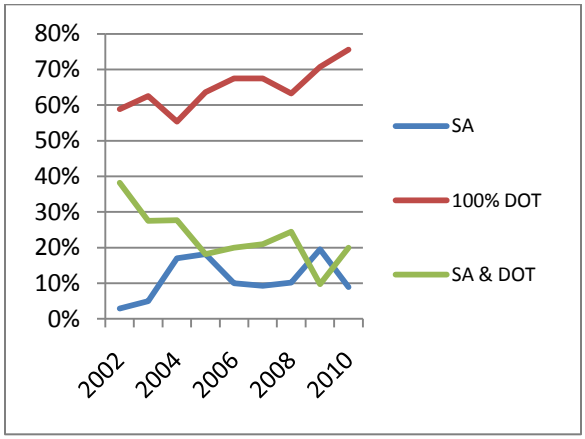


Figure 9: TB Cases by Mode of Treatment Admin.

Contact Investigations

The lungs are the most common site for TB disease. In Iowa, pulmonary cases accounted for 65% of the total cases during the last ten years (Figure10). Patients with either pulmonary (lungs) or laryngeal (throat) TB are infectious.

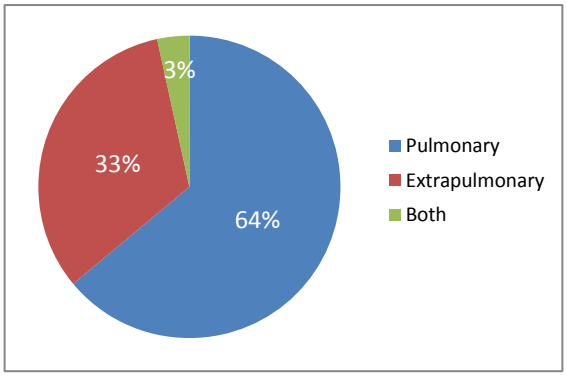


Figure 10: Iowa TB Cases by Site of Disease 2002-2011

All infectious cases require a contact investigation by the LPHA **to identify contacts** who:

- Have LTBI so treatment for LTBI can be given and active disease can be prevented.
- Have TB Disease so that they may be treated and further transmission can be stopped.

TB Contact Investigations, Iowa 2003-11
Cases for investigation: 194
Number of contacts identified: 4,380
Number of contacts who completed evaluation: 3,841 (87%)
Number of LTBI identified: 739 (19%)
Number of TB cases identified: 24

Figure 11: Contact Investigation Data

Each infectious TB case in the United States has 10 contacts identified on average per CDC. Approximately, 20%-30% of all contacts have LTBI, and 1% has TB disease. Of those contacts that ultimately will have TB disease, approximately half acquire disease in the first year after exposure. For this reason, contact investigations constitute a crucial prevention strategy.

LPHAs in Iowa are responsible for conducting investigations of infectious TB. Public Health agencies work closely with other agencies (e.g., Community Health Centers, private providers, labs etc) to ensure the prompt reporting of suspected TB cases.

The TB Control Program Manager and TB Nurse Consultant provide consultation to LPHAs on each infectious case of TB. Consultation consists of:

- When to initiate a contact investigation
- Assigning priorities to contacts
- Diagnostic and public health evaluation of contacts
- When to expand a contact investigation
- Data management of contact investigations

Contact investigations are timely, costly and consume limited resources from local, state and federal assets. "Contact investigations typically require hundreds of interdependent decisions, the majority of which are made on the basis of incomplete data, and dozens of time consuming interventions." [5] For these reasons, consultation and collaboration among LPHAs and the TB Program is vital to the diagnostic and public health evaluation of contacts.

[5] *Guidelines for the Investigation of Contacts of Persons with Infectious TB – Recommendations from the National TB Controllers Association and CDC*).

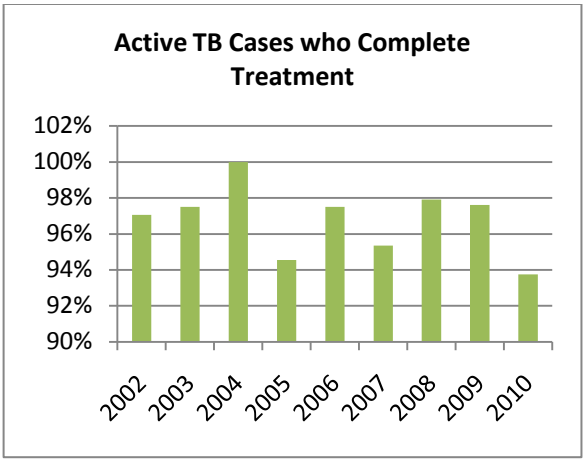


Figure 12: Percentage of Iowa TB Cases who Complete Therapy 2002-2010

Figure 12 represents the percentage of patients who completed treatment from 2002 – 2010. During this period, all patients with infectious TB completed treatment. Patient's not completing treatment had extrapulmonary TB, were not infectious and did not represent a public health risk.

TB Cases in Iowa

In 2011, Iowa reported 40 cases of active TB disease. Since 2002, Iowa averaged almost 44 cases of TB each year. (Figure 13: Number of TB cases 2002-2011). Although case rates are declining, many cases have existing co-morbidities that make TB treatment considerably more complex and require extensive care, including the use of second line drugs. Treatment with second line drugs is complicated and expensive, requiring expert consultation and extended treatment durations.

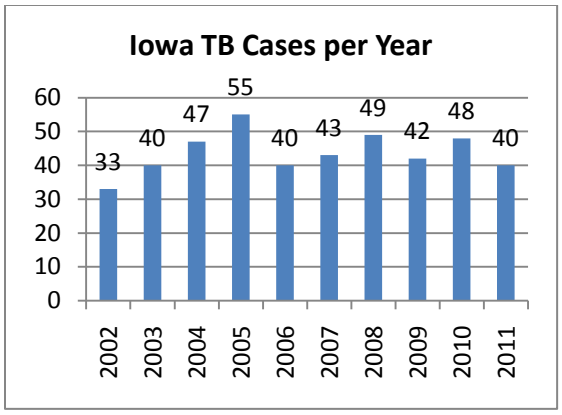


Figure 13: Number of Iowa TB Cases per Year 2002-2011

Counties with larger population centers such as Polk, Woodbury and Black Hawk report the majority of TB cases. However, as Figure 14 illustrates, many (55/99) Iowa counties reported TB cases during calendar years 1999-2008.

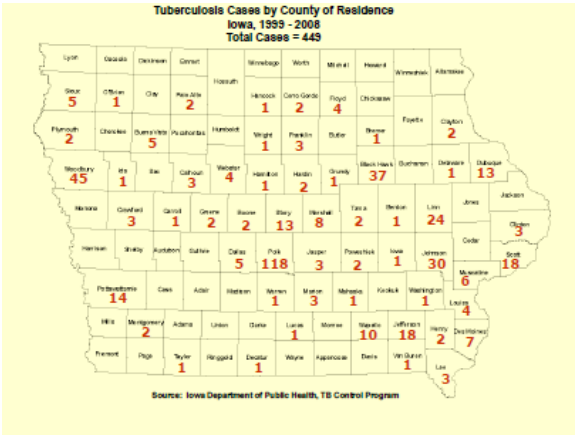


Figure 14: Iowa Counties with TB Cases 1999-2008

The 2011, TB case rate for Iowa is 1.3 cases per 100,000 persons. This is significantly lower than the national average of 3.6 cases per 100,000 persons. Iowa owes its low TB case rate in part to proficient contact investigations, healthcare providers observance of treatment guidelines, adherence to DOT for active disease cases and the provision of medication for LTBI to thousands of Iowan's annually.

The proportion of reported TB cases in non-U.S. born persons has increased significantly in the past two decades. In 1995 for example, non-U.S. born

persons accounted for 38% of reported TB cases Iowa. From 2002 – 2011, non-U.S. born persons accounted for 66% of reported TB cases Iowa (figure 15). Non-U.S. born persons account for only four percent of the Iowa population, highlighting the disparity. The decreasing numbers of U.S. born cases are due in part to effective TB control practices in this country.

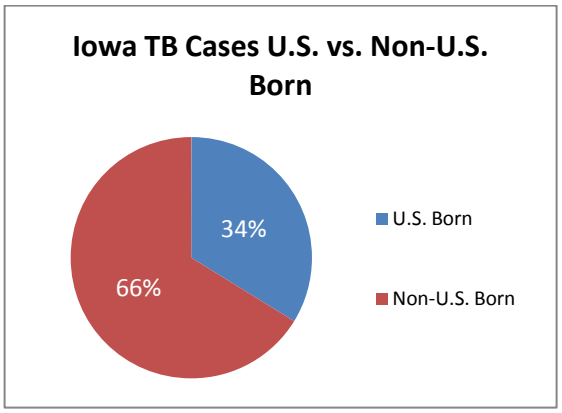


Figure 15: Percent of U.S. born Versus Non-U.S born TB cases in Iowa 2002-2011

As illustrated by the WHO World TB Report, in many parts of the developing world, TB is still widespread and remains a leading cause of death. Immigration of peoples from these countries to the United States illustrates what happens in one part of the world, directly impacts other parts of the world. Effective targeted testing programs for newly arriving refugees, immigrants, and students play a major role in identifying and treating these populations.

Country of Origin Data

For 2011, 29 individuals emigrating from 15 countries (excludes U.S.) developed TB in Iowa. Figure 16 represents 290 individuals, emigrating from 47 countries (excludes U.S.) who developed TB disease after their arrival to Iowa 2002-2010. As the map illustrates, TB anywhere is TB everywhere. Approximately 95% of all patients with active TB disease live in the developing world, where 99% of all TB deaths occur. TB is a good example of the global nature of public health. It is important to implement consistent and aggressive public health measures to halt TB disease, which left untreated, kills half of its victims.

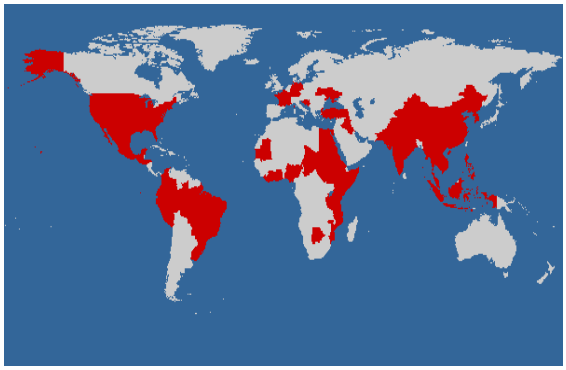


Figure 16: Iowa TB Cases by Country of Origin 2002-2010

Funding

In fiscal year 2011, the TB Control Program received funds from the federal TB Cooperative Grant and state funds totaling $484,649.00. Federal funds comprise 73% of the total budget while state funds comprise 27% of the program finances. (Figures 17-19)

Funding Source FY 2011	
Federal TB Cooperative Grant	$353,361
State	$131,288
Total	**$484,649.00**

Figure 17: FY 2010 total program funds

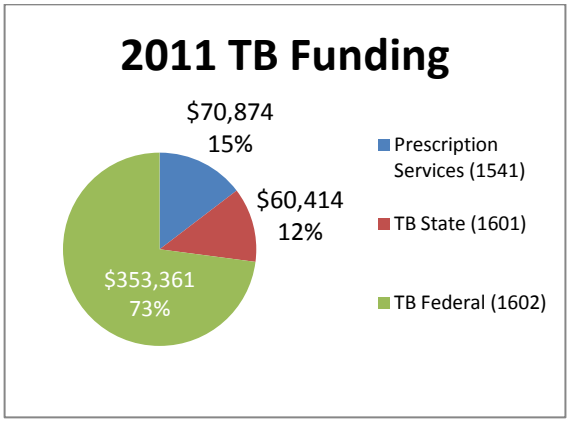


Figure 18: FY 2011 total program funds by funding source

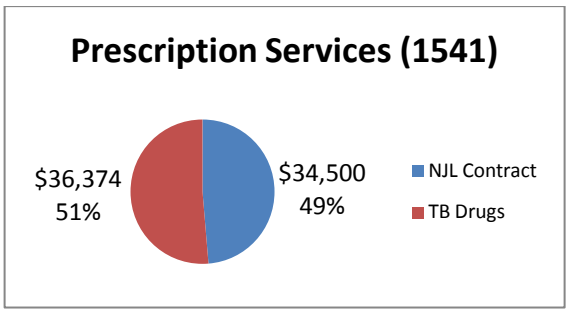


Figure 19: FY 2011 TB State (1541)

Program expenditures are divided into three main categories: program infrastructure (staff salary and operating expenses), contracts (including incentive funding for local public health agencies for directly observed therapy, NJL pharmacy for prescription services), and the State Hygienic Lab (SHL) for TB testing. The funding distribution for these three categories is illustrated in Figure 21.

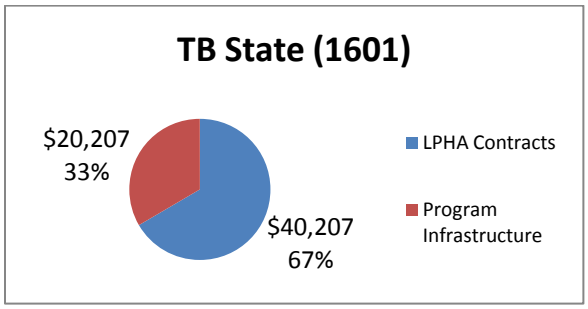


Figure 20: FY 2011 TB State (1601)

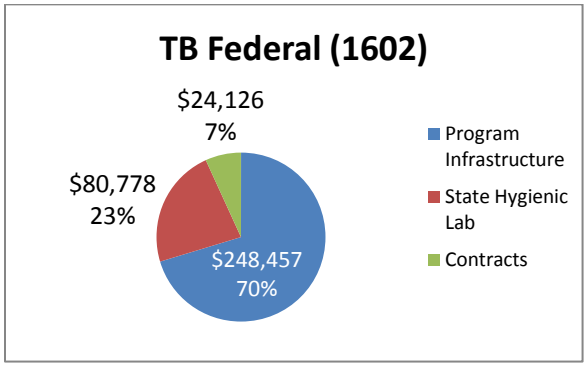


Figure 21: FY 2011 TB Federal (1602)

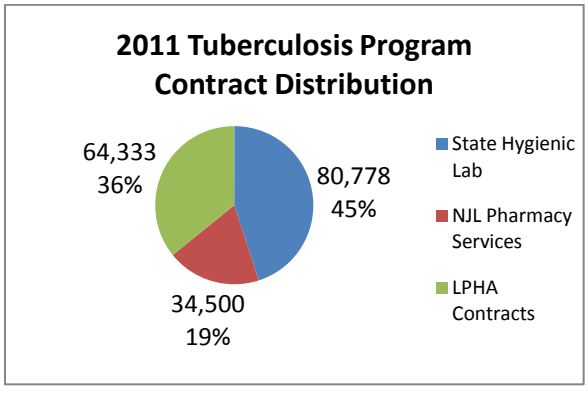


Figure 22: FY 2011 total funds distribution

Contract Funds

State Hygienic Lab

The TB Control Program contracts with State Hygienic Lab (SHL) through the *Tuberculosis Elimination Cooperative Agreement*. This agreement allows SHL to be the primary source for public health submission of suspect TB patient's specimens (typically sputum) for evaluation. The goal of SHL is to provide objective information within 24-48 hours of specimen receipt for smear and TB NAAT (rapid detection of MTB complex as well as rifampin drug resistance). SHL works with CDC to transfer clinical specimens of patients for whom second line drug testing is necessary. Additionally, SHL coordinates genetic testing of all culture positive MTB specimens with CDC to allow genetic linking of cases nationwide. The ability to rapidly and accurately detect drug resistance in *Mycobacterium tuberculosis* Complex (MTBC) clinical isolates is critical for the appropriate treatment of patients suffering from TB and the effectiveness of TB control programs.

SHL also is one of the few labs in the state that performs Interferon-Gamma Release Assays (IGRAs). IGRAs are whole-blood tests that can aid in diagnosing TB infection. SHL offers Two IGRAs that have been approved by the U.S. Food and Drug Administration (FDA) and are commercially available in the U.S: QuantiFERON TB Gold In-Tube test (QFT-GIT); and T-SPOT®.*TB* test (T-Spot). IGRAs are of particular use to LPHAs in the course of a contact investigation to an infectious TB patient. In a contact investigation, IGRAS are offered to Iowa citizens free of charge through the SHL. In 2011, the TB Control Program contract amount with SHL was $80,778.00 as demonstrated in figure 22.

Pharmacy Services

The TB Program contracts with NJL Pharmacy of Pleasant Hill, Iowa to dispense all of the TB medications for both LTBI and active TB disease patients. In 2011, the TB Control program spent $36,374.00 on TB medications for Iowa citizens. The contract for pharmacy services is $34,500.00 as demonstrated in Figure 19.

Local Public Health Agencies:

Iowa is unique in its ability and desire to provide incentive funding for LPHA's who provide directly observed therapy (DOT) to active pulmonary patients in their county. DOT is a standard of care for TB in which patients are observed to ingest each dose of anti-tuberculosis medications, to maximize the likelihood of completion of therapy. Programs utilizing DOT as the central element in a comprehensive, patient-centered approach to case management (enhanced DOT) have higher rates of treatment completion than less intensive strategies.

The CDC/American Thoracic Society (ATS) and Infectious Disease Society of America (IDSA) all recommend healthcare providers implement DOT on each active case of TB. Eligibility of LPHAs for DOT incentive funding may vary from funding cycle to funding cycle; but generally, all infectious (pulmonary and laryngeal), pleural, HIV positive, and childhood cases of TB disease are eligible. In 2011, the Iowa TB Control Program spent $40,207.00 on contracts with LPHAs for DOT services as shown in figure 20.

Omar's Story

The story begins years ago in Somalia. Omar (not his real name) and his sister fled the civil war in Somalia after soldiers killed their brother and father. They lived in a refugee camp in Kenya for ten years before immigrating to the U.S. While in the camp, Omar met the woman who would become his wife.

Dadaab camp, Kenya. The world's biggest refugee settlement is home to more than 400,000 people Photograph: Sven Torfinn for the Guardian

There, she gave birth to all five of their children. He worked as a nurse, attending to thousands with various medical afflictions, most because of living in horrendous conditions with little to no access to proper medical care. It was here that Omar developed TB. Like others in camp suffering from communicable diseases like TB, he did receive treatment, albeit sporadic. Still, he thought he was cured, as did the civil surgeons who cleared him for travel to the United States. However, like most persons living in refugee camps, his treatment was sub-standard and paved the way for him to develop multidrug-resistant tuberculosis (MDR-TB). MDR TB is a form of tuberculosis that is resistant to two or more of the primary medicines used for treatment. MDR-TB has a 5-year death rate comparable to lung cancer, meaning 85% of those afflicted will not be alive within 5 years of diagnosis. Worse still is that improperly treated MDR-TB may lead to extensively drug resistant TB (XDR-TB). The estimated death rate for XDR-TB is near 100%.

In 2007 Omar and his family arrived to Iowa and he quickly found work in a Fortune 500 company. Less than ten months later, a hospital admitted Omar with a one-month history of fever, coughing up blood, and weight loss. Tests confirmed he had MDR-TB. This became the first MDR-TB case reported in Iowa since 1999.

MDR-TB and XDR-TB are not found in nature. They are entirely man made and occur as a result of incomplete or inadequate treatment. As a global health threat, these two forms of TB are significant challenges to effectively control TB. MDR/XDR-TB is transmitted to others when sick persons cough, sneeze, speak or sing, just like "normal" TB.

Omar received extensive treatment and remained hospitalized for two months. He received daily directly observed treatment (DOT) at home from a public health nurse who wore a motorized respirator at each visit. He remained at home while under voluntary isolation until he was no longer infectious. Even when he became non-infectious, treatment continued for a lengthy period of time. The normal treatment for TB is six months while the treatment for MDR-TB is two years. The second line of medicines needed to save Omar's life have many side effects. One of the medicines often causes severe psychosis and suicidal ideations. Another can cause deafness. When the choice is deafness or death, the choice becomes painfully clear. At a point in his treatment, surgery to remove part of his lung was considered. Prognosis for a full recovery was guarded.

The public health investigation to detect if Omar infected others revealed that all five of his children (ages 18 months – 12 year old) had TB infection due to MDR-TB exposure. A worksite investigation identified two additional persons to have infection. All seven of these infected persons required a complex treatment regimen to prevent them from developing MDR-TB. DOT was required for all of the MDR-TB infected contacts to guard against them developing MDR-TB. These medicines often caused Omar's children to have diarrhea and to vomit. Still, this is modern medicines best shot at ensuring they and the others do not develop MDR-TB, but there is no guarantee.

Public health nurses ensured his children took 180 doses of the experimental drug cocktail. When the children vomited the doses, as they often did, the nurses could not count that day's dose. Instead, doses had to be 'added on' to the end of treatment. For two of the children, treatment lasted nearly 10 months.

After two years of taking multiple TB medicines administered by public health nurses, Omar completed his TB treatment and doctors pronounced him cured. Omar is thankful to all the doctors and nurses that helped him beat a disease that was trying to kill him.

The public health and private sector response to this event was intensive, devouring limited resources. It is clear the repercussions of not treating these infected persons properly could prove disastrous to Iowans, both in terms of health and dollars. Omar and his family know this cost all too well.